24. (New) The method of claim 23, wherein the electrical characteristic is a voltage at the output terminal.

25. (New) The method of claim 24, wherein capturing the measurement includes closing a first sampling switch connecting a capacitor to the output terminal, storing a charge on the capacitor, opening the first sampling switch to capture the measurement, and closing second sampling switch connecting the capacitor to the feedback circuit to provide the measurement to the feedback circuit.

26. (New) The method of claim 23, wherein the electrical characteristic is a current passing through the filter.

27. (New) The method of claim 26, wherein capturing the measurement includes closing a first sampling switch connecting a first plate of a capacitor to a first terminal of the power switch, closing a second sampling switch connecting a second plate of the capacitor to a second terminal of the power switch, storing a charge on the capacitor, opening the first sampling switch and the second sampling switch to capture the measurement, and closing a third sampling switch connecting the capacitor to the feedback circuit to provide the measurement to the feedback circuit.

28. (New) The method of claim 23, wherein the measurement is captured just prior to the power switch closing.

29. (New) The method of claim 23, wherein the measurement is captured just prior to the power switch opening.

30. (New) The method of claim 23, wherein a first measurement of the electrical characteristic is captured when the power switch is closed and a second measurement of the electrical characteristic is captured when the power switch is open.

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31. (New) The method of claim 30, further comprising averaging the first and second measurements, and using the average to control the power switch.

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32. (New) The method of claim 24, wherein capturing the measurement includes closing a first sampling switch connecting a capacitor to an electrical path between the input terminal and the output terminal, storing a charge on the capacitor, opening the first sampling switch to capture the measurement, and closing second sampling switch connecting the capacitor to the feedback circuit to provide the measurement to the feedback circuit.

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33. (New) The method of claim 32, further comprising driving the power switch with switching voltage waveform, driving the sampling switches with a sampling voltage waveform, and delaying the switching voltage waveform relative to the sampling voltage waveform.

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34. (New) The method of claim 33, wherein the switching voltage waveform is delayed relative to the sampling voltage waveform by approximately the time constant delay of the sampling circuit.

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35. (New) The method of claim 23, further comprising generates a control signal with the feedback circuit, and setting the duty cycle in response to the control signal with a pulse modulator that receives the control signal from the feedback circuit.

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36. (New) The method of claim 35, further comprising converting the measurement into a charge with one or more switched-capacitor circuits in the feedback circuit, and generating the control signal from the charge.

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37. (New) The method of claim 35, further comprising converting the measurement into a digital signal with an analog-to-digital converter (ADC) coupled to the sampling circuit, and generating the control signal from the digital signal with a processor coupled to the ADC.

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38. (New) The method of claim 23, wherein alternately coupling and decoupling the input terminal to the output terminal includes connecting the input terminal to an intermediate terminal with a first switch and connecting the intermediate terminal to ground with a rectifier.

39. (New) The method of claim 38, wherein the rectifier is a second switch.

40. (New) A method of operating a voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

alternately coupling and decoupling the input terminal to the output terminal with a power switch;

filtering a current between the input terminal and the output terminal to provide a substantially DC voltage at the output terminal;

closing a first sampling switch connecting a capacitor to the output terminal;

storing a charge on the capacitor;

opening the first sampling switch to capture a measurement of a voltage at the output terminal at a discrete moment of time;

closing a second sampling switch connecting the capacitor to the feedback circuit to provide the measurement to the feedback circuit; and

using the measurement to control the power switch to maintain the DC voltage substantially constant.

41. (New) A method of operating a voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

alternately coupling and decoupling the input terminal to the output terminal with a power switch;

filtering a current between the input terminal and the output terminal to provide a substantially DC voltage at the output terminal;

closing a first sampling switch connecting a first plate of a capacitor to a first terminal of the power switch;